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(54) **Movable transparent panel structure to close the roof of an automobile.**

(57) A panel of glass or transparent sheet material for use as a transparent sunroof for automobiles, is formed by two sheets and an air gap therebetween, with a sealing bead (3) holding the sheets (2,3) together at a desired distance from each other, the holes through which the elements (8,11) for assembly of the sheets (2,3) to the roof being left on the outside.

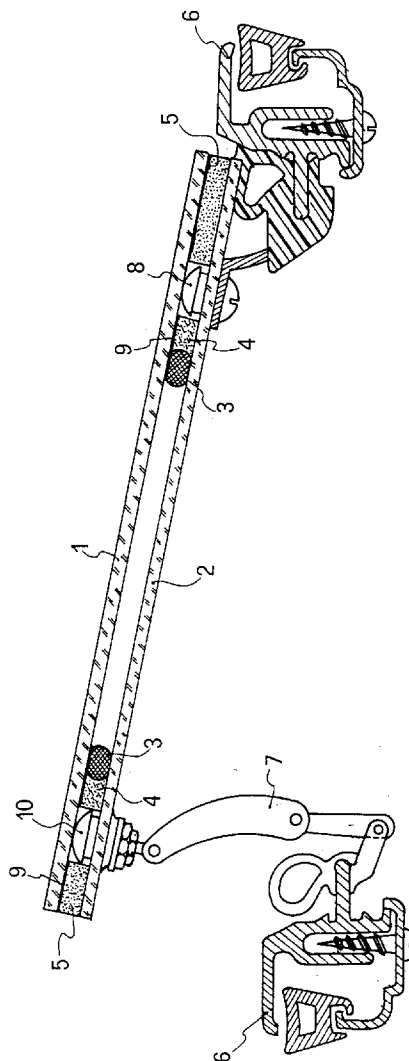


FIG 2

The present invention relates to a panel for automobiles, and in particular to a panel made of glass or transparent plastic material.

A panel of this type is commonly known as a sun roof, and for preference replaces that part of the metal roof above the front seats.

5 The panel is made of glass or other transparent material and has a light and energy transmission factor not exceeding 25% of the incident energy, so as to avoid unpleasant irradiation on the inside. By light and energy transmission factor, the flow of light or energy directly transmitted through the glass is intended.

In order to obtain the above characteristics, sun roofs are generally made of glass having a thickness of between 3 and 5 mm, provided with suitable silk-screen coatings and/or thin reflective layers.

10 By the use of these opening sun roofs in automobiles it is possible to increase comfort, in particular during the hotter months of the year, thanks to the improved circulation of air within the interior of the vehicle.

However, there are certain problems during the colder months of the year, when the high level of humidity and the cold outside cause misting of the inner surface. Furthermore, the difference in temperature between the inside and the outside of the vehicle generates an unpleasant feeling of cold at the level of the occupants' heads.

15 In order to avoid the above problems, sliding false roofs made of the same materials as the inside upholstery are at present installed in the roofs of automobiles, which act as a screen separating the transparent sun roof from the rest of the interior during the colder months.

20 Use of said false roof is sometimes advisable even during summer months, in particular in the presence of extremely strong sunshine.

It can be appreciated that the production and assembly of the above false roof is the case of additional costs.

Object of the present invention is therefore to eliminate said false roof, thus reducing the overall manufacturing costs of an automobile provided with an opening sun roof.

25 A further object of the present invention is that of providing a transparent sun roof having characteristics of improved comfort for passengers, during both the winter and the summer months.

In order to attain said objects, the transparent sun roof is made of double-glazing, using two sheets of glass separated by an air gap which is carefully sealed so as to prevent humidity from entering between the sheets of glass.

30 Furthermore, the sun roof manufactured as above has for preference on one or more of its surfaces reflecting and/or opaque surfaces so as to obtain extremely low transmission levels.

The sun roof also has solutions for its anchorage to the metal structure of the automobile, on the one hand in order to guarantee the best possible seal against the entry of external currents of air into the interior, and on the other hand so as not to endanger the insulation characteristics obtained.

35 thus be said that, in the field of sun roofs for automobiles, a new product has been obtained.

The advantages obtained from use of this product are the following: increased comfort within the interior of the vehicle, both during the warmer months and during the colder ones; increased passive safety with respect to sun roofs made using a single sheet of glass; elimination of misting on the surface closest to the heads of the occupants; the possibility of obtaining with greater versatility a number of characteristics, using different surface treatments on the four surfaces of the two sheets of glass available; in contrast, only two surfaces (an internal and an external one) are available at present in opening sun roofs made of glass according to the prior art; decrease in noise; elimination of the protective false roof.

40 In short, the object of the invention is a movable panel of transparent glass or plastic sheet material, assembled in an aperture of the roof structure of a vehicle, and capable of closing and opening said aperture, characterized in that it comprises:

an external sheet and an internal sheet assembled face to face and at a given distance one from the other, so as to form an air gap therebetween, assembly holes being provided in one of said sheets;

a continuous adhesive bead in contact relation with said external and internal sheet substantially along the edge thereof, said bead forming the edge of the air gap and holding said sheets together at a predetermined distance, said assembly holes being left on the outside of said air gap with respect to said bead; and

50 mechanical assembly elements through said assembly holes to fix said moving panel to said structure of the roof of the vehicle, so that said aperture in the roof is closed by a double-glazing with an air gap and in which said sheets can also be surface treated so as to control transmission of luminous and/or thermic energy therethrough.

55 Further advantages and characteristics of the invention will be evident from the following description, given merely as a non-limiting example with reference to the accompanying drawings, in which:

figure 1 shows a top view of a sun roof according to the present invention;

figure 2 shows a cross-section view along line A-A of a sun roof according to the present invention;

figure 3 shows a cross-section view along line A-A of an alternative embodiment of the sun roof according to the present invention.

According to the present invention the drawings show a sun roof made of a double-glazing structure formed by a sheet of glass 1 held together with another sheet of glass 2, by means of a bead 3 which can be made, for example, of butyl rubber. As an example, the butyl rubber produced by the company CHEMETALL can be used, which is also capable of absorbing the humidity imprisoned in the air gap between the two sheets of glass, thanks to special absorbent elements present in the butyl mixture.

External sealing 4 of the sheet is performed using a polysulphide resin, for example M 82 also produced by CHEMETALL.

An opaque layer 9 is placed along the edge of the internal face of the external sheet 1, in such a way as to protect the beads of adhesive and/or sealant from ultraviolet rays, which could in the long term compromise their mechanical characteristics.

With reference to figure 2, the two sheets of glass 1 and 2 have the same shape and the same sized perimetral length.

As can be seen from figure 1, the adhesive bead 3, 4 runs substantially along the edge of the sheets of glass, leaving to the outside with respect to the air gap the holes formed in the internal sheet, as illustrated in figure 2. These holes serve to insert the elements for assembly of the transparent panel to the structure of the roof of the automobile.

Screws 8 connect the sheet of glass 2 to hinges (not illustrated) for fixing to a support structure formed from a group of known structural elements and generally indicated with 6. Other screws 10 connect the sheet of glass 2 to the handle 7 which serves to raise the sun roof from the roof of the vehicle and to rotate it around the hinges (not illustrated), which can be of the type currently used.

A further bead of sealing adhesive 5 is used to seal the screws 8 and 10 from the outside.

This solution is particularly advantageous should it be desired to improve the air penetration coefficient of the vehicle, as there are no parts projecting on the outside, given that the screws 8, 10 are situated below the external sheet 1.

With reference to figure 3, which shows an alternative embodiment of the invention with respect to figure 2, the sun roof is formed by the assembly of two sheets of glass having the same shape but different sizes. In particular the internal sheet 2 is smaller than the external sheet. In this case, securing to the supporting structure is obtained by screws 11 which connect the external sheet only to the hinges (not illustrated) and by screws 12 which again connect the external sheet of glass to the handle 7.

This technical solution has the advantage that no significant modifications have to be made to the fixed structure of the opening, as the sun roof to be assembled there is a standard one.

The above description refers to a sun roof which is preferably hinged along one of its two long sides and is movable along the other long side. However, the same solutions can also be applied to horizontally movable or even completely removable sun roofs. Furthermore the same solutions can also be applied both to flat or curved sheets of glass.

In order to improve the comfort of sun roofs according to the present invention, the surfaces of one or both the sheets of glass giving onto the air gap can be coated with thin reflecting or low-emission layers obtained using physical or chemical deposition techniques. In the case of a double-glazing sunroof, it is possible to obtain, on the two inner surfaces of the air gap between the sheets of glass 1 and 2, two thin layers having different characteristics which, when combined, allow the desired thermal insulation values to be obtained. This has not been possible up to now using sunroofs made of a single layer of glass.

Furthermore, a neutral gas such as argon can be inserted into the air gap, thus increasing the thermal insulation characteristics and in particular reducing the value of the thermal transmission coefficient.

The following illustrates the results obtained by means of a double-glazing sunroof according to the present invention, when compared with the results obtained with a sunroof according to the prior art.

It is known from the prior art that the comfort obtained with a sunroof can be measured with the aid of certain coefficients. In particular comfort during the winter can be measured using the thermal transmission coefficient K expressed in $W/m^2 \text{ } ^\circ C$, whereas summer comfort can be measured using the solar factor SF expressed in % of incident energy, while the ability to generate misting on the glass is measured using the relative humidity coefficient RH.

The best comfort is obtained in conditions where SF and K are low, and RH is high.

In the following table, given merely as an example, the following have been compared:

- 1) a sunroof comprising a single sheet of clear glass with a thickness of 3 mm coated with a thin reflecting layer;
- 2) a double-glazing sunroof comprising one sheet of clear glass with a thickness of 3 mm coated on the inside with a thin reflecting layer, an air gap interspace with a thickness of 3 mm, and another sheet of

clear glass with a thickness of 3 mm;

3) a sunroof comprising one sheet of clear glass with a thickness of 3 mm coated on the inside with a thin reflecting layer, an air gap with a thickness of 3 mm, and another sheet of clear glass with a thickness of 3 mm coated with another thin reflecting layer.

The following values are the results of experimental tests, and refer to a sun roof and to a car in movement:

	TL	TE	K	SF	RH
			W/m ² °C		
Glass 1	10%	7%	8.6	11%	29%
Glass 2	9%	6%	4.6	8%	53%
Glass 3	9%	5%	4.3	7%	55%

It can thus be seen that a sunroof made of a double-glazing greatly improves the internal comfort of a vehicle.

In addition to, or in alternative to the presence of thin reflecting layers, inks or opaque enamels can be applied to one of the surfaces of the two sheets, for example by means of silk-screen processes. In this case the designs obtained can be of various kinds, such as checks of varying fineness in which opaque squares or dots alternate with transparent squares or dots to form known geometrical figures, for example diamonds and the like.

Claims

1. A movable panel of transparent glass or plastic sheet material, assembled in an aperture of the roof structure of a vehicle, and capable of closing and opening said aperture, characterized in that it comprises:
 - an external sheet (1) and an internal sheet (2) assembled face to face and at a given distance one from the other, so as to form an air gap therebetween, assembly holes being provided in one of said sheets;
 - a continuous adhesive bead (3, 4) in contact relation with said external and internal sheet substantially along the edge thereof, said bead forming the edge of the air gap and holding said sheets together at a predetermined distance, said assembly holes being left on the outside of said air gap with respect to said bead; and
 - mechanical assembly elements (8, 10, 11) through said assembly holes to fix said moving panel to said structure of the roof of the vehicle, so that said aperture in the roof is closed by a double-glazing with an air gap and in which said sheets can also be surface treated so as to control transmission of luminous and/or thermic energy therethrough.
2. A movable panel according to claim 1, in which said adhesive cord (3) holding said external and internal sheet together contains substances capable to absorb the humidity in the air gap.
3. A movable panel according to claim 1 or 2, in which said mechanical elements connect the internal sheet to said structure of the roof of the vehicle.
4. A movable panel according to claim 1 or 2, in which said internal sheet has an outer perimeter smaller than that of the external sheet, and said mechanical elements connect said external sheet to the structure of the roof of the vehicle.
5. A movable panel according to any one of the preceding claims, in which said mechanical elements are nuts and bolts.
6. A movable panel according to any one of the preceding claims, in which said internal and external sheet have substantially the same outer perimeter, and a further sealing adhesive bead (5) is interposed between said sheets along their edges, on the outside of said holes.
7. A panel according to any one of the preceding claims, in which an opaque layer (9) is applied on the inner surface of the external sheet above said adhesive and sealing beads (3, 4, 5) for protection from ultraviolet

rays.

8. A movable panel according to any one of the preceding claims, in which thin reflecting layers are applied on one or on both the surfaces of the sheets facing into the air gap.

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9. A movable panel according to any one of the preceding claims, in which a design is applied to one of the surfaces of said sheets by means of opaque enamels, in order to reduce light transmission by the glass.

10. A movable panel according to any one of the preceding claims, in which said panel is assembled on hinges fixed to the roof of the vehicle.

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11. A movable panel according to any one of claims 1 to 9, in which the panel is assembled to the roof of the vehicle in a sliding relationship.

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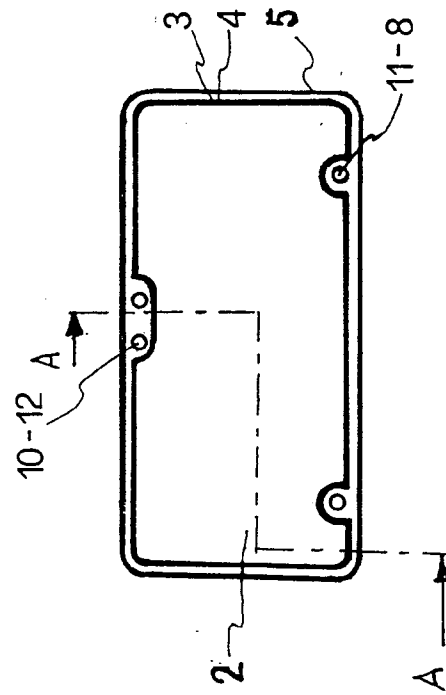
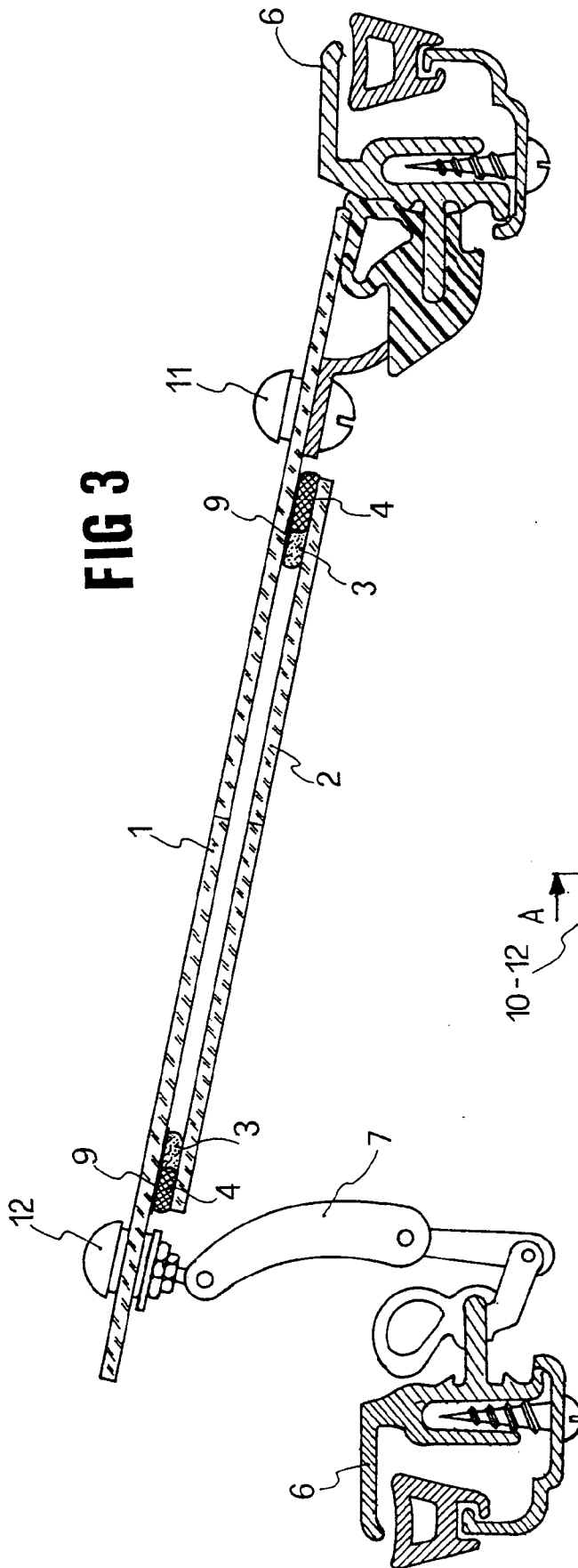
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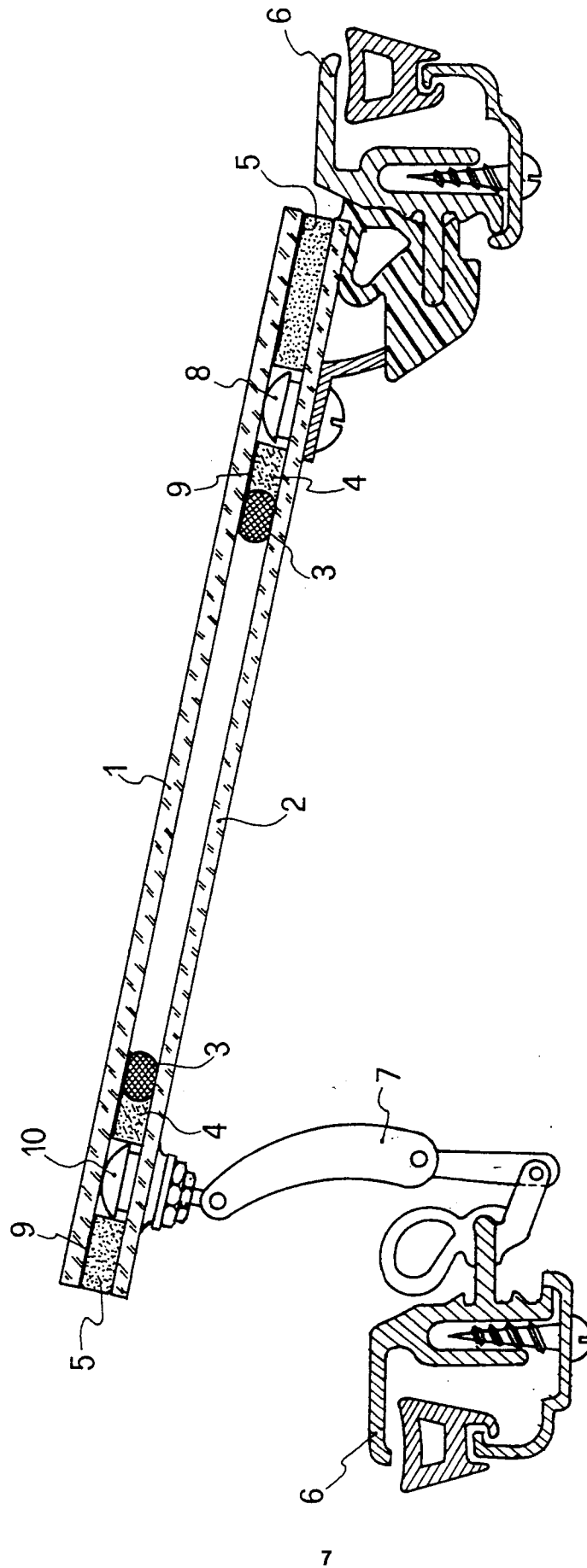
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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 93 83 0320

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	EP-A-0 307 280 (VEGLA) * the whole document * ---	1-3	B60J7/08 B60J7/043 B60J7/053
Y	EP-A-0 238 164 (TALIQ CORPORATION) * abstract; figures 1,2 * ---	1-3	
Y A	EP-A-0 076 218 (FARNIER ET PENIN) * the whole document * ---	1,5,10 2-4	
Y A	EP-A-0 411 879 (NISSAN) * abstract; figure 4 * -----	1,5,10 6-9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			B60J
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		11 November 1993	FOGLIA, A
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